Activated Alumina

Activated alumina is an adsorbent used in packed beds to remove fluoride, arsenic, selenium, beryllium, and natural organic matter from water.

See related Fact Sheets: Acronyms & Abbreviations; Glossary of Terms; Arsenic.

1.0 Applicable Contaminants

Activated alumina is an EPA listed BAT for the removal of arsenic, fluoride, uranium, and selenium.

2.0 Description of Technology

Pretreatment Cartridge filtration should be used as pretreatment for solids removal with activated alumina. Additionally, pre-oxidation and pH control are recommended [1]. Pre-oxidation or feed water pH adjustment may be necessary to enhance removal of target contaminants. For example, the activated alumina process is more effective in removing As(V) than Arsenic (III) so pre-oxidation of As(III) to As(V) can improve the removal efficiency of activated alumina. The pH of the raw water should be adjusted and maintained between 5.5 and 6.0 to facilitate Arsenic removal. At higher pH values, the activated alumina surface has a net negative charge which can electro-statically repel anions, reducing its efficiency [2].

Technology Description Activated alumina is a granulated form of aluminum oxide. This material is highly porous and has a very large surface area, over 200 m^2/g. Activated alumina adsorption is a physical/chemical process in which ions in solution are removed on the oxide surface. Feed water is passed continuously through one or more activated alumina beds. Loading rates can range from 3 to 5 gpm/ft^2 [3]. Typically filters are greater than 3 feet deep [4]. Periodically, the activated alumina media is backwashed to remove any solids that have accumulated in the system. Backwash rates vary from 8 to 10 gallons per minute depending on the diameter of the filter [4]. When all available sites are occupied, the activated alumina media must either be regenerated with a strong base or disposed of entirely.

Waste Disposal The waste product from the regeneration of spent activated alumina is caustic and contains high concentrations of the contaminant removed and may be considered a hazardous waste.

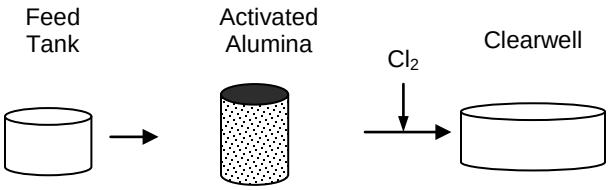
Maintenance Activated alumina processes must be maintained to minimize bacterial growth in the canister or cartridges. System pressure and flowrate checks are necessary to verify effectiveness of backwashing.

Water quality monitoring is necessary to ensure contaminant removal. Regular replacement of media may be required and is based on contaminant type, concentration, and rate of water usage. The manufacturer's recommendations for media replacement should be consulted. Periodic cleaning with an appropriate regenerant such as $Al_2(SO_4)_3$, acid, and/or caustic will extend media life. Activated alumina may need to be replaced approximately every one to three years.

Benefits Activated alumina is well understood, well established, and reliable. Activated alumina is capable of meeting the desired product water requirements for arsenic removal and requires minimal operator involvement.

Limitations Regeneration of resins may generate hazardous waste. Requires routine monitoring to determine when regeneration is necessary.

4.0 Example Treatment Train*



*** Acid addition and pre-oxidation are optional.**

5.0 Safety and Health Concerns

Sodium hydroxide or other caustic solution is often used for resin regeneration. Personal protective equipment is required for handling all chemicals. Regeneration waste and spent media may be characterized as a hazardous waste and must be disposed of properly.

6.0 References

1. AWWA Water Treatment Plant Design. New York, McGraw-Hill, 2005.
2. Wang, L., A. Chen, K. Fields. Arsenic Removal from Drinking Water by Ion Exchange and Activated Alumina Plants. EPA/600/R-00/088, October 2000.
3. Industrial Wastewater Management, Treatment, and Disposal. Water Environment Federation, McGraw-Hill, 2008.
4. Flow and Backwash Chart for Various Filter Media. Pure Water Products, LLC, 2008.

Contact Information

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